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MEMO

To: Distribution
From: D. Eyles
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Herewith my notes from the G&N debriefing, August 4 in Houston. Mostly they concern the descent, as this was the preponderant topic and the most interesting. Toward the end are a few notes on ascent and a strong comment by Collins on how busy we keep the CSM pilot during rendezvous. Fast note taking requires real-time condensation and condensation requires interpretation, so errors of emphasis are possible. Unless specified otherwise, it is Neil Armstrong who is answering.

Distribution:

Pippinger
Marscher
Kriegsman
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Pu
Covelli
Cherry
Nevins
M. Johnston
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D. Moore
Hoag
Copps
Hamilton
Martin

Was the 1r circuit breaker closed at the time of the code 500 "alarm" (actually a V50N25 with checklist code 500) in P63? No. Aldrin incorrectly remembers this alarm as happening before the R60 manoeuvre. Circuit breaker was open which is good as it explains why the alarm occurred with the antenna actually in position 1, for no discrete is sent when power is off. Evidently the LMS didn't simulate this correctly.

Was the V57 before the first alarm (1202) in P63? Order was (1) data good (2) at 38:01 yaw to face up (3) at 38:09 V16N68 (4) at 38:21 first alarm. Answer: believe not. V57 was later.

AGS Hdot was checked at one point late in the landing and was not wildly wrong.

Apparently pitch oscillations were felt in P64 around 5000 feet after the point where for about 8 seconds Neil flew pitch manually in attitude hold.

Attitude response in P66? As anticipated. "crisp and responsive." Translation control? What do you mean? Could you see the effect of attitude on translation? ((Inane question.)) Yes could see effect. There was some lateral velocity he could account for except speculatively by dust movement. He felt he may have been overcontrolling a little. At one moment he thought he was moving rearward at 1 or 2 f/s.

Was LPD creep noticeable? Didn't look until 2000 feet. On roughly 4 peaks roughly 10 seconds apart the spot indicated by the LPD moved downrange about one crater diameter, 1/4 mile. Creep not unexpected.

Using LPD for finding Surveyor? Couldn't say as he didn't use it. Would be willing to try. Could have used it sooner (if not distracted by alarms) i.e. at 5000-10000 feet could have used it. Would there have been adequate time? "Time goes very fast." But time for a stab at it anyway.

Visibility before high-gate? Yes. ((We should tell Conrad that LPD angle is available in P63 via V16N64.)) Of value? Saw horizon significantly before expected, it seemed not long after face up. Camera was high up in the window so it never lost the horizon, someone comments.

Trajectory? 300-500 feet is an important place to have time. He would have redesignated short not long as the near edge of that crater seemed an interesting place to go.

Would he exchange visibility for delta V? No conclusion.

Unexpected flying qualities? No. ROD worked well. There was difficulty in determining lateral (also but less so vertical) translation below 100 feet. Out-the-window difficulty thanks to dust. New window marks? No. Problem is seeing the surface through the dust. Need discontinuities to show through the thin layer of moving dust but he would expect these most anywhere on the Moon. Not hard, but one has to be mentally prepared to be distracted by the moving dust.

He heard many jet firings during P63. Could hear little from the DPS and couldn't even detect 10% thrust on, only throttle-up. Felt he heard periodic jet firings throughout the descent, just assisting attitude control it seemed.

Relative usefulness of cross-pointers and tape meters versus DSKY? Armstrong was looking out the window. Armstrong had a "target fixation". Aldrin would smoothe DSKY information as the read it to Neil. He cross checked the DSKY occasionally with the tape meters. DSKY more useful says Aldrin.

Descent trajectory looks "spastic" because he changed his mind 3 times or so. Apology. Neil described this mind changing in detail but too rapidly to copy.

Was wash-out localized? Wash-out was no problem. Could see into wash-out well. Could fly a steeper angle. Films make wash-out look worse.

Did he look out the window at all near high-gate? Very little. Concern was with understanding the alarm problem and keeping the machine flying.

Could you have distinguished a 5 or 10 degree slope? No. Much difficulty perceiving slopes. Of course a big area couldn't slope that much without its being noticeable. That is a big area couldn't "support" that kind of a slope.

Would a steeper angle aid Apollo 12? Safety and visibility? Could accept some steepening if it did not take away from the time in the 200-500 foot region. Need time there to make the final site decision.

Lower high-gate? Not willingly.

T/W and thrust meters at FTP? Noticed bias in chamber pressure.

Did you notice the low fuel light when it came on? Aldrin says yes.

Graduated propellant indicators? Improvement possible in that area.

Neil was feeling pressure to get on the ground.

Need for new displays? No comment right now. Aldrin again complains about V16 and having to repeat it.

What reaction to the 8 second blank DSKY after software restart? Seemed like a long time, chuckle. Never expected it to light again. Just kept flying. Helpful below 10000 feet to be able to continue using tape meters and cross-pointers alone. It was these being reasonable that indicated PGNCS still good when the DSKY was blank.

Aldrin asks if the ground knows what the alarms are when they happen. Garman says yes. If yes ground should read them aloud. Garman says something. Apollo 12 making a placard. Apollo 11 had one too but it didn't include the ones that happened. Laughter.

Distance judgement? Good enough. Was right in estimate of crater size within a factor of 2. Rocks were Volkswagen size, not twice that or 3 feet. Could tell at 3000 feet.

Faster or slower period? P66 could be faster says Aldrin.

All pre-ignition marks on the ground showed them 2-3 seconds long. Out-of-plane Neil thought was close but this was complicated by yaw for communications reasons.

ROD reaction? Smoother, not jumpy though chamber pressure bounced. It was "physiologically" smoother.

How about giving up pre-high-gate visibility? Okay. Should be willing to give up what you never expected to have and didn't use.

At 300 feet gave ROD many up-blips to go downrange. "Mind changing exercises."

Just for visibility would take a lower sun angle if given a choice, but this is not a strong feeling.

Neil would prefer forward velocity to the present omni-directional horizontal velocity in Noun 60.

No contamination of the AOT after landing. Particles visible, probably from venting, says Aldrin.

Could you have gone at T-2. Yes but there was only 1-2 minutes to spare. Ascent oscillations? Were a $2\frac{1}{2}$ degree limit cycle and 5 deg/sec rates. That's not a bad ride says Armstrong. Slow motion sensation. Horizon check "second-rate".

4 degree initial manoeuvre to the vertical from the tilt angle not noticed. Clean staging made the impression. "Good mood" on ascent. Hdot reassuring as it meant you weren't plopping back down. (Plops hand on table.)

PGNCS and AGS pulse modes? Didn't fly the latter in the light configuration. Sporty. Pulse mode acceptable but alignments difficult.

Didn't use the eyecup of the AOT but pressed cheek to hand to position the eyeball. Eyeball had to be in just the right position.

Collins: need less CSM participation during rendezvous. Fewer keystrokes. Estimates 800 (or "a hundred"?) keystrokes during rendezvous, too many. Should be made simpler for the CSM pilot. Too much time spent working the computer poorly places you in two ways: (1) it gives you little time to deal with malfunctions (2) it makes it impossible to take stock and perceive trends, for you get behind on the DSKY.

Collins feels he could have rescued.

CSM do CSI or/and CDH perhaps? Collins likes the idea of either vehicle being able to do these. Does not want to diminish CSM's RCS fuel margin however.